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## THE GENUS *PODISMA* IN EASTERN NORTH AMERICA.

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*Podisma* (Latr.) is a particularly interesting genus of Melanopli, since it is the only one of that immense group that occurs in the Old World, where, indeed, it is represented by considerably more described species than it is in North America. It is also of interest from its distinctly boreal and alpine distribution, being almost peculiar to high latitudes or altitudes. It is a circumpolar genus, inhabiting the mountains and boreal parts of Europe, Asia and North America, a larger number of species having been described from Europe than elsewhere.

The North American species are found in two widely-separated regions: the Rocky Mountain region from Alberta to New Mexico in the west, and from North-western Ontario to Maine and south to Pennsylvania in the east. It is to the eastern species that the reader's attention will be directed in the present paper.

Although in some cases *Podisma* is but narrowly separable from *Melanoplus*, it is on the whole a distinct type, differing from the latter chiefly in the widely-separated mesosternal lobes, the interspace in the male being transverse and as wide or nearly as wide as the lobes themselves, and in the female strongly transverse and as wide as or wider than the lobes. The pronotum is always short and sometimes subcylindrical, with the lateral carinæ poorly defined or absent, and the hind margin truncate or slightly emarginate, or at most obtusangulate. The tegmina are normally abbreviate, and often entirely absent. Of the North American species, those from the east have no tegmina, while of the western forms these organs are present in all but one species.

Two species of *Podisma* have been described from eastern North America, *P. glacialis*, Scudd., from the mountains of New England, New York and Pennsylvania, and *P. variegata*, Scudd., from specimens taken at Ithaca and Enfield Falls, Tompkins Co., N. Y. Before the description of the latter was published the writer sent drawings to Mr. Scudder of specimens of *Podisma* taken at De Grassi Pt., Lake Simcoe, Ont., which were pronounced *P. variegata*, and later on specimens from the same locality were sent to him. On Sept. 12th, 1900, while collecting at North

Bay, Lake Nipissing, 175 miles north of De Grassi Pt., a series of specimens of *Podisma* were taken, which showed features belonging to both species, but were nearer *P. glacialis*. Some of these were sent to Mr. Scudder, who named them *glacialis*, "varying slightly towards *variegata*, especially in the (feebly) banded hind femora."

Since then I have collected a considerable series of specimens from two localities intermediate in latitude between Lake Simcoe and Lake Nipissing, viz., at Tobermory, near Cape Hurd (Bruce Co.), and at Algonquin Park. I have also examined a series of 4 ♂♂ and 3 ♀♀ taken at several different localities in Pennsylvania, belonging to the museum of the Academy of Natural Sciences of Philadelphia, and kindly loaned to me through Mr. J. A. G. Rehn. To complete my collection, I have specimens of typical *glacialis* from the following localities in New England: Mt. Washington, N. H. (3 ♂♂, 3 ♀♀); Greylock Mt., Mass. (2 ♂♂, 2 ♀♀); Speckled Mt., Stoneham, Me. (3 ♂♂, 3 ♀♀).

A careful study of all these specimens has revealed a complete series of gradations from the typical *glacialis* of the White Mountains to the typical *variegata* from Pennsylvania, though these extremes are widely different, not only in structure and markings, but in habits and character of environment.

The chief points of distinction between the two forms as given by Mr. Scudder may be tabulated as follows:

	<i>P. glacialis</i> .	<i>P. variegata</i> .
Eyes.	Moderately prominent.	Very prominent, especially in the ♂.
Antennæ.	Slightly shorter than hind femora.	Distinctly longer than hind femora (♂).
Hind femora.	Yellowish grass-green, obscurely bifasciate with dark olivaceous green.	Flavo-testaceous, broadly bifasciate with blackish fuscous.
Furcula.	Crosses basal fifth or less of supra-anal plate.	Hardly longer than last segment.
Cerci of ♂.	Stouter, middle breadth not less than $\frac{2}{3}$ basal breadth.	Very long and slender; middle breadth less than $\frac{1}{2}$ basal breadth.

A study of my series gives the following results:

1. Eyes.—Those of the N. E. specimens (typical *glacialis*) are the least prominent, the specimens from Mt. Washington having less prominent eyes than those from Speckled Mt. and Greylock Mt. Among the rest of

the series there is but little variation, the greatest degree of prominence being seen in the Pennsylvania specimens (typical *variegata*) and the Lake Simcoe specimens. The eyes of some of the ♂♂ from North Bay approach pretty closely those of the ♂♂ from Speckled Mt., and the ♀♀ from the latter locality are quite like those from North Bay in this respect. There is, however, very little range of variation among the Canadian specimens. An idea of the total amount of variation in the prominence of this organ can be obtained from the accompanying plate.

2. Antennæ.—The variation in the length of this structure can be seen by a glance at the table of measurements. The specimens from Mt. Washington have relatively the shortest antennæ, and it is plain from the measurements of the New England specimens that they average distinctly shorter than the Canadian specimens. From Algonquin Park southward to Pennsylvania, except at high altitudes, we find a gradual but steady increase in the length of the antennæ, the longest ones belonging to Pennsylvania specimens. In typical *variegata* the antennæ of the ♂ are distinctly longer than the hind femora, in *glacialis* slightly shorter. In most of the Canadian specimens they are about equal in length, being faintly shorter in the North Bay specimens, faintly longer in those from Lake Simcoe.

3. The hind femora are relatively shortest in the N. E. specimens, but are practically constant in length throughout the remainder of the series. Some of the Algonquin Park series, however, are inseparable from the N. E. specimens on this score. A more important feature is the colour and distinctness of the bands of the hind femora. In specimens from Algonquin Park and North Bay, like those from N. E., they are uniform green, with the faintest traces of bands, but in the majority from this locality they are more or less distinctly though feebly banded, the lighter areas being yellowish green. A number of ♂♂, however, have the superior sulcus as conspicuously banded as in the Pennsylvania specimens. The hind femora of the latter are in the ♂ strongly fasciate with pale yellowish and dark brown or blackish, the contrast being much greater in the main than in the specimens from Lake Simcoe, which most resemble them. Every gradation is present in the series.

4. The furcula shows great diversity of size and form. As with the other characters, the most northern of the Ontario specimens are most like typical *glacialis* in the form of this structure, and it is longest in some of the North Bay and Algonquin Park specimens, shortest in the Pennsyl-

vania series. Some from North Bay, however, have the furcula as short as those from Lake Simcoe (figs. 56, 57, 58.)

5. Cerci of ♂.—Next to the furcula this structure shows the greatest range of variation. It is much stouter in typical *glacialis* than in typical *variegata*, and Scudder used the character as one of the chief ones by which the two species could be distinguished. A glance at the plate, however, will suffice to show that no separation into two species can be based on the form of this structure. Some of the North Bay specimens have the cerci of typical *glacialis*, but there is a perfectly gradual series of transitions from the stout cerci of the more northern forms to those of the Pennsylvania ones, in which they are most slender. In order to illustrate these transitions as accurately as possible, I have drawn the cerci of all the ♂ specimens, from N. E., North Bay, Algonquin Park, Tobermory and Pennsylvania, and a sufficient number from L. Simcoe to complete the range of variation.

Other variations of less importance are to be found, especially in the general colour and character of markings, but they add nothing to the facts gained from the above.

From these comparisons it is readily seen that the specimens from Mt. Washington and those from Pennsylvania are the most widely separated, but that the wide gaps between them can be filled by a complete series of links represented by the Canadian specimens, the most northern of which closely approach the N. E. specimens, the most southern the Pennsylvania ones.

These variations, hence, appear to be connected with differences in the climatic conditions, and it would seem that temperature is an important factor. They are also accompanied by certain changes in the insect's habits, as evinced by some interesting facts that have been recorded on this subject. Mr. Scudder states that in the White Mts. *P. glacialis* "frequents the close branches of the dwarf birch, and is rarely or never seen upon the ground," while Mr. Morse found most of his specimens "on or among the various species of *Vaccinium*, characteristic of mountain-tops and on Ascutney upon dwarf cornel" (Psyche, 1898, 273). It occurs at elevations of 2,000 to 5,400 feet, in New England, New York and Pennsylvania, but has also been taken at lower levels at Jackman, Me., on the Canadian border, "in open woods and bogs" (Harvey.—Psyche, 1897, 77). At North Bay and Algonquin Park I found the insect common in open woods on bushes, chiefly the common beaked hazel

(*Corylus rostrata*) and the red raspberry. It occurs in both dry and fairly moist situations. The specimens from Tobermory were taken under similar circumstances, while at De Grassi Pt. they seem to be confined to swampy ground where the vegetation is of a boreal character. In such places I have taken them on bushes, chiefly raspberry, but have often found them on the branches and trunk of the *Arbor-vitæ*, sometimes 8 or 10 ft. from the ground. I have never observed this habit in the north, although the species is far more abundant there, but Mr. J. A. G. Rehn says, in an interesting article on "The Habits and Distribution of *Podisma variegata*" (*Ent. News*, XI., 630), that in Pennsylvania they occur on the branches of hemlock, and that when removed they will quickly return.

From these various facts it may be inferred that *P. glacialis* is the more primitive form, especially as the genus is typically an alpine one, and that it once inhabited a much larger area, but after the retreat of the ice-sheet it disappeared from this area, except in the northern part and on the mountains farther south. *Variiegata*, on the other hand, may be regarded as an incipient species, the product of an effort on the part of the parent species to survive amid the altered conditions of its environment. These conditions, as we go southward, diverge more and more from those to which the insect was originally adapted, and hence it is not surprising to find slight modifications of structure and colour-pattern corresponding in degree with these changes.

Its occurrence in swampy stations southward is what would be expected from the fact that wet soil is a poor conductor of heat, and such places are cooler than the more open, dry country, but its fondness for hemlock in Pennsylvania seems to indicate a distinct specialization in the insect's habits in this locality. Further observation, however, is desirable on this point.

As many of my Canadian specimens can be classed equally well with *glacialis* or *variegata*, it will be necessary to give a new racial name to these forms, and I have accordingly subdivided the species as follows, though it will be understood that these different geographical races cannot be sharply separated from one another :

- A. Antennæ distinctly shorter than hind femora (♂), nearly three-fourths as long (♀). Eyes not very prominent. Hind femora nearly uniform green externally, obscurely bifasciate with darker green. Furcula crossing basal fourth or fifth of supra-anal plate. Cerci of

♂ rather stout, middle breadth not less than two-thirds the basal breadth.

Habitat—Mountains of New England.—*P. glacialis*, Scudd., type.

- B. Antennæ about as long (♂), about five-sixths as long (♀) as the hind femora. Eyes prominent, especially in the ♂. Hind femora green externally, more or less distinctly bifasciate with darker green, especially on the superior sulcus. Furcula generally crossing less than the basal fifth of the supra-anal plate, but longer than the last segment. Cerci of ♂ about half as broad in middle as at base.

Habitat—Northern Ontario.—*P. glacialis Canadensis*, new race.

- C. Antennæ longer (♂), faintly shorter (♀), than hind femora. Eyes prominent, especially in the ♂. Hind femora pale-yellow externally, strongly bifasciate with dark-brown or blackish. Furcula about as long as the last segment. Cerci of ♂ less than half as broad in middle as at base. Habitat—New York, Pennsylvania, Ontario (L. Simcoe, Tobermory).—*P. glacialis variegata*, Scudd.

Specimens from Lake Simcoe and Tobermory may be placed with *variegata*, but are not quite typical. I have seen no specimens of *glacialis* from the mountains of New York and Pennsylvania, so that I have given them no place in the above table. They will probably fall under *P. glacialis* type.

#### MEASUREMENTS.

##### Males.

	Antenna.	Head and Pronotum.	Hind Femur.	Body.
	mm.	mm.	mm.	mm.
Mt. Wash. 3 spec.....	8.1-8.2 Av. 8.15 (2 spec.)	5.5-5.8 Av. 5.53	9.5-9.7 Av. 9.57	17.0-17.5 Av. 17.3
Speckled Mt. 3 spec.....	9.0-9.2 Av. 9.1 (2 spec.)	5.7-5.8 Av. 5.73	9.0-9.7 Av. 9.4	17.0-18.0 Av. 17.7
New England. (Morse) 48 spec.	8.0-9.0		9.5-10.8	15.0-17.5
North Bay. 8 spec.....	8.5-9.0 Av. 8.8	5.4-5.8 Av. 5.62	9.5-10.3 Av. 9.9	17.0-18.0 Av. 17.27
Algonq Pk. 14 spec.....	8.0-10.0 Av. 8.66	4.8-5.7 Av. 5.19	8.4-10.0 Av. 8.8	15.0-17.5 Av. 16.1
Tobermory. 5 spec.....	10.0-10.5 Av. 10.16	5.7-6.0 Av. 5.84	10.0-10.8 Av. 10.24	17.5-18.5 Av. 18.44
Lake Simcoe. 14 spec.....	10.0-11.0 Av. 10.5	5.3-6.3 Av. 5.79	9.5-10.5 Av. 10.08	17.5-20.0 Av. 18.4
Penn'a. 4 spec.....	12.0 (1 spec.)	5.3-5.8 Av. 5.52	9.5-10.2 Av. 9.8	16.5-18.5 Av. 17.5
Ithaca, N. Y. (Scudder).....	10.5		9.25	16.5

	Females.			
	Antenna.	Head and Pronotum.	Hind Femur.	Body.
	mm.	mm.	mm.	mm.
Mt. Wash. 1 spec.....	7.2	7.0	12.0	25.0
Speckled Mt. 3 spec.....	8.2-9.0 Av. 8.6 (2 spec.)	6.3-7.0 Av. 6.6	10.0-11.5 Av. 10.9	21.0-26.0 Av. 23.0
New England. (Morse) 62 spec.	7.0-8.5		10.0-12.0	19.0-28.0
North Bay. 5 spec.....	9.0-10.5 Av. 9.9	6.3-7.0 Av. 6.86	12.0-12.6 Av. 12.4	21.5-25.2 Av. 23.9
Algonq Pk. 4 spec.....	9.0-9.2 Av. 9.1	6.0-6.8 Av. 6.47	10.2-12.0 Av. 11.2	20.0-24.0 Av. 21.7
Tobermory. 5 spec.....	9.0-11.0 Av. 10.12	6.5-7.5 Av. 7.09	12.2-13.5 Av. 12.3	22.0-26.5 Av. 24.8
Lake Simcoe. 8 spec.....	10.0-11.0 Av. 10.69	6.8-7.8 Av. 7.29	11.0-13.4 Av. 12.4	24.5-26.5 Av. 25.37
Penn'a. 3 spec.....	11.5 (1 spec.)	6.5-7.0 Av. 6.66	12.0-12.5 Av. 12.25	21.0-24.5 Av. 22.83
Ithaca, N. Y. (Scudder).....	8.5 +		12.75	23.5

Fig.	EXPLANATION OF PLATE 6.			
1, 2, 7.	<i>Podisma glacialis</i> , type, ♂ cercus.	Mt. Washington, N. H.		
3, 4.	" " " "	Greylock Mt., Mass.		
5, 6, 8	" " " "	Speckled Mt., Stoneham, Me.		
9.	" " " "	From Scudder (Rev. Mel.).		
48.	" " " ♂, head and pronotum.	Mt. Washington, N. H.		
49.	" " " " " "	Speckled Mt., Me.		
53.	" " " ♂, supra-anal plate and furcula.	Speckled Mt., Me.		
61.	" " " ♂, hind femur.	Speckled Mt., Me.		
10-17.	" " <i>canadensis</i> , ♂ cercus.	North Bay, Ont.		
18-31.	" " " "	Algonquin Park, Ont.		
50.	" " " ♂, head and pronotum.	North Bay, Ont.		
54-56.	" " " ♂, supra-anal plate and furcula.	North Bay, Ont.		
62, 63.	" " " ♂, hind femur.	North Bay, Ont.		
32-36.	" " <i>variegata</i> , ♂ cercus.	Tobermory, Bruce Co., Ont.		
37-42.	" " " "	Lake Simcoe, Ont.		

43.	<i>Podisma glacialis, variegata</i> , ♂ cercus.	From Scudder (Rev. Mel.).
44, 45.	“ “ “ “	North Mt., Penn'a.
46.	“ “ “ “	Bellasyva, Wyo. Co., Pa.
47.	“ “ “ “	Glen Omoko, Sull. Co., Pa.
51.	“ “ “ ♂, head and pronotum.	Lake Simcoe, Ont.
52.	“ “ “ “ “ “	North Mt., Pa.
57, 58.	“ “ “ ♂, supra-anal plate and furcula.	Lake Simcoe, Ont.
59, 60.	“ “ “ ♂, supra-anal plate and furcula.	North Mt., Pa.
64.	“ “ “ ♂ hind femur.	Lake Simcoe, Ont.
65.	“ “ “ “ “ “	Bellasyva, Pa.

ON THE SYSTEMATIC POSITION OF THE ORTHOPTEROUS  
GENUS AULOCARA, SCUDDER.

BY A. N. CAUDELL, WASHINGTON, D. C.

Too late for correction, I find that in my recent paper on western Orthoptera\* I have redescribed Scudder's *Aulocara rufum* as a new species under the name *guanieri*, placing it in the not very nearly related genus *Heliastus*. This unfortunate mistake was brought about by the uncertain position of the genus *Aulocara*, which possesses both tryxaline and œdipodine characters. The general aspect of the species of the genus is certainly very strongly œdipodinean and the characters of the declivate vertex, subperpendicular front, filiform antennæ, small round eyes, obsolete lateral carinæ, twice or thrice severed median carina, wrinkled pronotum, and of the generally present intercalary vein, all indicate close affinity to the CEdipodinæ. McNeill, in his revision of the Tryxalinæ†, excludes this genus, but Scudder considers it to belong to that group. *Ædocara*, Scudd., and the invalid genus *Coloradella* of Brunner von Wattenwyl‡, are synonyms of *Aulocara*, and under the former name Saussure places it in the CEdipodinæ§, and *Coloradella* was established as a tryxaline genus. Thus there is considerable difference of opinion among specialists as to the systematic position of *Aulocara*. Upon thoroughly studying the group characters exhibited by our species of this genus, I feel very certain that its logical position is in the CEdipodinæ.

\* Proc. U. S. Nat. Mus., xxvi., 775-809 (1903)

† Proc. Davenp. Acad. Nat. Sc., vi., 179-274 (1897).

‡ Ann. Mus. Genoa (2) xiii., 123 (1893).

§ Prodr. CEdipod., suppl., 15 (1888).